Probability and Statistics Standards and Learning Activities

PS.1. Demonstrate understanding of the definition of the notion of independent events and use the rules for addition, multiplication, and complementation to solve for probabilities of particular events in finite sample spaces.

Example: If you draw two cards at random from a standard deck of 52 cards, what is the probability that both are hearts? Now draw a third card. What is the probability that the third card is a heart if the first two were already hearts?

PS.2. Know the definition of conditional probability, and use it to solve for probabilities in finite sample spaces.

Example: Roll two dice.

What is the probability that the sum of the faces is even?

What is the probability that the result is a pair?

What is the probability that you have a pair if the sum is even?

PS.3. Demonstrate understanding of the notion of discrete random variables by using them to solve for the probabilities of outcomes (e.g., the probability of the occurrences of five heads in 14 coin tosses).

Example: Toss a coin 15 times and let X *denote the number of times that the result is "heads". Compute each of the following probabilities:*

A. $P(X = 0)$

B. $P(X > 0)$

C. $P(X = 1)$

PS.4. Apply uniform, normal, and binomial distributions to the solutions of problems.

Example You are about to take a quiz with 4 true-false questions. What is the probability that you will get at least 3 out of 4 correct if you make a random guess on each question?

Example: If Z *is a normal random variable with mean 0 and standard deviation 1, what is the probability that* Z *is greater than 0?*

Example: If Z *is a normal random variable with mean 0 and standard deviation 1, compute* $P(|Z| < 1)$.

Example: Quality control for a manufacturing process measures the weight of parts at the end of the production line. The weights follow a normal distribution with mean weight 45 ounces and standard deviation 0.5 ounces. One part is chosen at random for testing. What is the probability that this part will weigh more than 46 ounces?

PS.5. Determine the mean and the standard deviation of a normally distributed random variable.

PS.6. Know the definitions of the mean, median, and mode of a distribution of data, and compute each in particular situations.

Example: Give an example of a small data set (3 or more data points) for which the mean is greater than the median.

A class of 25 students is asked to determine approximately how much time the average student spends on homework during a one-week period. Each student is to ask one of his/her friends for the information, making sure that no one student is asked more than once. The numbers of hours spent on homework per week are as follows:

8, 0, 25, 9, 4, 19, 25, 9, 9, 8, 0, 8, 25, 9, 8, 7, 8, 3, 7, 8, 5,

3, 25, 8, 10

Example: Find the mean, median, and mode for these data. Explain or show how you found each answer.

Example: Based on this sample, which measure (or measures) that you found in part a best describes the typical student? Explain your reasoning.

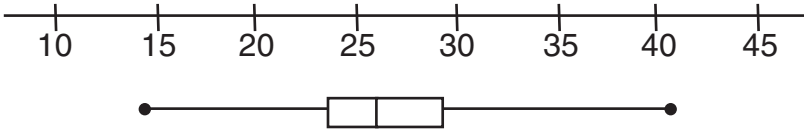
Example: Describe a sampling procedure that would have led to more representative data.

(See also PS.7, PS.8)

PS.7. Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.

PS.8. Organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatter plots, and box-and-whisker plots.

Example: The box-and-whisker graph shown below represents the results of a survey of the estimated gas mileage of 100 car models.



What is the median gas mileage?

What are the best and worst gas mileages in the survey?

What range contains about 50% of the outcomes?

PS.9. Describe and explain how the relative sizes of a sample and the population affect the validity of predictions from a set of data.

PS.10. Approximate a line of best fit (trend line) given a set of data (e.g., scatter plot).